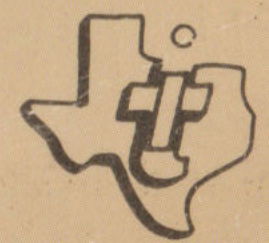


TI PROGRAMMABLE 58/59

Quick Reference Guide



TEXAS INSTRUMENTS



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TI-PROGRAMMABLE 58/59

QUICK REFERENCE GUIDE

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CALCULATING NOTES

Low Battery Indication.

If the display flashes erratically, fades out, gives incorrect results or is inconsistent in any way, recharge the battery. Calculator operation can be resumed after several minutes of recharging.

ALGEBRAIC HIERARCHY (A.O.S.).

Operations and functions are performed automatically in following order :

1. Math functions (x^2 , cos, etc.).
2. Exponentiation (y^x) and Roots ($\sqrt[x]{y}$)
3. Multiplications and divisions
4. Addition and subtraction
5. Equals

Order applies to each set of parentheses. You can use up to 8 pending operations and 9 open parentheses except where noted.

FLASHING DISPLAY.

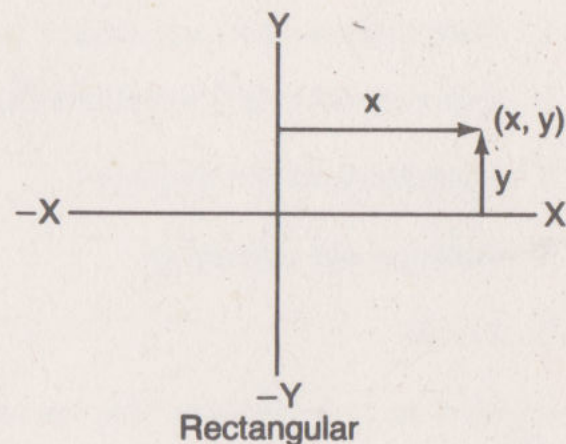
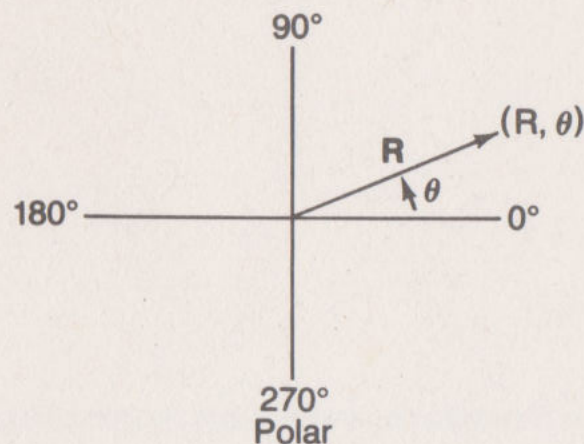
A display flashing off and on indicates that an invalid key sequence has taken place or that the limits of the display have been exceeded. See Appendix B in «Personal Programming» for possible causes.

CONVERSIONS

ANGLES FORMATS

2nd D.MS — DEGREES, MINUTES, SECONDS TO DECIMAL DEGREES — Converts an angle measured in degrees, minutes and seconds to its decimal equivalent. **INV 2nd D.MS** reverses this conversion. Also used for time conversion. Operates on display value only. Submit 2 digits each for minutes and seconds. Entry and display format is DD.MMSSsss where DD is degrees, MM is minutes, SS is the whole seconds and sss is fractional seconds.

POLAR / RECTANGULAR



Polar to Rectangular Sequence

R **2nd** **D.MS** θ **2nd** **P $\rightarrow$ R** $\rightarrow y$; **2nd** **D.MS** $\rightarrow x$

Rectangular to Polar Sequence

x **2nd** **D.MS** y **INV 2nd** **P $\rightarrow$ R** $\rightarrow \theta$; **2nd** **D.MS** $\rightarrow R$

Only 4 pending operations are available for other uses when using D.MS or Polar/Rectangular conversions.

STATISTICS

Initialize : 2nd Pgm 1 SBR CLR

Data Entry : x_i $\Sigma\pm$ y_i 2nd $\Sigma+$.

Data Entry Removal : x_i $\Sigma\pm$ y_i INV 2nd $\Sigma+$.

Trendline Data Entry : x_1 $\Sigma\pm$, y_1 2nd $\Sigma+$, y_2 2nd $\Sigma+$, etc.

Trendline Point Removal : $\Sigma\pm$ - 1 = $\Sigma\pm$ y_i INV 2nd $\Sigma+$

Calculations	Key Sequence
Mean of y-array then x-array	2nd $\bar{x}$ $\Sigma\pm$
Standard Deviation (N - 1 Weighting) of y-array then x-array (N Weighting of y-array then x-array)	INV 2nd $\bar{x}$ $\Sigma\pm$ INV 2nd 0p 11 $\sqrt{x}$ $\Sigma\pm$ $\sqrt{x}$
Variance (N Weighting) of y-array then x-array (N - 1 Weighting of y-array then x-array)	2nd 0p 11 $\Sigma\pm$ INV 2nd $\bar{x}$ x^2 $\Sigma\pm$ x^2
Y-Intercept	2nd 0p 12
Slope after y-intercept	$\Sigma\pm$
Correlation Coefficient	2nd 0p 13
y' for new x	2nd 0p 14
x' for new y	2nd 0p 15

SPECIAL CONTROL OPERATIONS

There are a series of operations accessed through use of the **Op** key that can greatly boost the capabilities of your calculator. Some of these special operations can be used in any calculator mode while others are designed for a specific mode or for use with optional **PC-100A Print Cradle**.

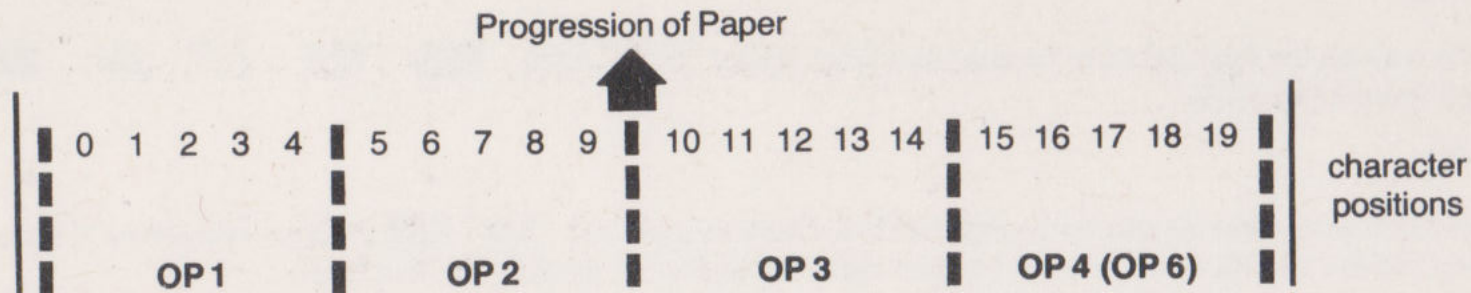
Each special control operation is called by pressing **2nd** **Op** **nn** where **nn** is the 2-digit code assigned to each operation (short form addressing can be used here). Brief code descriptions are listed below with complete definitions following.

Code nn	Function
00*	Initialize print register
01*	Enters 10 digits in display as 5 alphanumeric codes for far left quarter of print column.
02*	Enters 10 digits in display as 5 alphanumeric codes for inside left quarter of print column.
03*	Enters 10 digits in display as 5 alphanumeric codes for inside right quarter of print column.
04*	Enters 10 digits in display as 5 alphanumeric codes for far right quarter of print column.
05*	Print the contents of the print register.
06*	Print last 4 characters of OP 04 with current display value.
07*	Plot a * in column 0-19 as specified by the display.
08*	List the labels currently used in program memory.
09	Bring previously specified library program into program memory.
10	Apply signum function to display register value.
11	Calculate variances.
12	Calculate slope and intercept.
13	Calculate correlation coefficient.
14	Calculate new y prime (y') for an x in the display.
15	Calculate new x prime (x') for a y in the display.
16	Display current partition of memory storage area.
17	Repartition memory storage area.
18	If no error condition exists in a program, set flag 7 .
19	If an error condition exists in a program, set flag 7 .
20-29	Increment a data register 0-9 by 1.
30-39	Decrement a data register 0-9 by 1.

*Designed specifically for use with optional **PC-100A Print Cradle**

Alphanumeric Printing — Op 00-06

The first seven control operations allow you to create and print out alphanumeric messages. Twenty characters can be printed on each line. They are assembled and stored in groups of 5 characters at a time as shown below.



Each printed character is represented by a two-digit, row-column address code according to the following table:

		UNITS DIGIT							
		0	1	2	3	4	5	6	7
TENS DIGIT	0	blank	0	1	2	3	4	5	6
	1	7	8	9	A	B	C	D	E
	2	-	F	G	H	I	J	K	L
	3	M	N	O	P	Q	R	S	T
	4	.	U	V	W	X	Y	Z	+
	5	x	*	Γ	π	e	(	)	,
	6	↑	%	↓	/	=	"	x	Σ
	7	z	?	÷	?	II	△	Π	Σ

For instance, A is code 13 and + is code 47. The codes for five characters (10 digits) can be entered into the display at a time. If you do not specify all 10 digits, zeros are assumed to precede the digits entered (each zero pair represents a blank space). To obtain spaces after some characters, simply enter pairs of zeros after the codes of the characters.

PROGRAMMING NOTES

Labels

Any key on the keyboard can be used as a label except **2nd** , **LRN** , **Ins** , **Del** , **SST** , **BST** , **Ind** , and the numbers 0-9.

DSZ

This instruction can be used with registers 0-9. Entry sequence is **2nd** **Dsz** **X, N** or **nnn** where X is the data register used followed by the transfer address (label N or absolute address nnn).

Flags

Ten flags are available (0-9). Entry sequence for setting, resetting or testing flags is the flag instruction, flag number, then transfer address (testing only).

MEMORY PARTITIONING

Memory area is partitioned in sets of 10 registers where each register can hold a data value or 8 program instructions. To check placement of current partition, press **2nd** **Op** **16**. To repartition, enter number of sets (N) of 10 data registers needed and press **2nd** **Op** **17**.

N	Program/Data	
	TI-58	TI-59
N < 0 = N		
0	479/00	959/00
1	399/09	879/09
2	319/19	799/19
3	230/29 *	719/29
4	159/39	639/39
5	079/49	559/49
6	000/59	479/59 *
7	Flashing	399/69
8	Flashing	319/79
9	Flashing	239/89
10	Flashing	159/99
N < 10 = 10	Flashing	159/99

*Partition when calculator is turned on.

Key Codes In Numerical Order

Key Code	Key	Key Code	Key	Key Code	Key
00	0	39	2nd cos	72	STO 2nd Ind
09	9	40	2nd Ind	73	RCL 2nd Ind
10	2nd E	42	STO	74	SUM 2nd Ind
11	A	43	RCL	75	-
12	B	44	SUM	76	2nd lbl
13	C	45	y ^x	77	2nd x=t
14	D	47	2nd CMs	78	2nd Σ+
15	E	48	2nd Exc	79	2nd x̄
16	2nd A'	49	2nd Prd	80	2nd Grad
17	2nd B'	50	2nd x	81	RST
18	2nd C'	52	EE	83	GTO 2nd Ind
19	2nd D'	53	(	84	2nd Op 2nd Ind
20	2nd CLR	54	)	85	+
22	INV	55	÷	86	2nd St flg
23	Inx	57	2nd Eng	87	2nd If flg
24	CE	58	2nd Fix	88	2nd D.MS
25	CLR	59	2nd Int	89	2nd π
27	2nd INV	60	2nd Deg	90	2nd List
28	2nd log	61	GTO	91	R/S
29	2nd CP	62	2nd Pgm 2nd Ind	92	INV SBR
30	2nd tan	63	2nd Exc 2nd Ind	93	.
32	x=t	64	2nd Prd 2nd Ind	94	+/-
33	x ²	65	X	95	=
34	√x	66	2nd Pause	96	2nd Write
35	1/x	67	2nd x=t	97	2nd Dsz
36	2nd Pgm	68	2nd Nup	98	2nd Adv
37	2nd P→R	69	2nd Op	99	2nd Prt
38	2nd sin	70	2nd Rad		
		71	SBR		

Through normal usage you will become familiar enough with the more common instruction codes that constant reference to these tables will not be necessary. Most key codes can always be quickly determined by reference to the calculator keyboard or the "Key Code Overlay."

**READING MAGNETIC CARDS
(TI-59 Only)**

Display When Card Entered	Card with Normal Program	Card with Protected Program
0	Reads information into bank number listed on card if current partition matches that on card. If partition incorrect, card is passed, but not read — display flashes card side passed.	Same as for normal program
1, 2, 3, 4	Expects card with this side number to be read — displays that side number. If another side is entered or if partition is incorrect, card is passed but not read — display flashes card side passed.	If side passed numerically matches the display, card is read and side is displayed as negative. If another side is entered or if the partition is incorrect, card is passed but not read — display flashes card side passed.
-1, -2, -3, -4	Forces side read into this bank number regardless of card number or partition. A protected program cannot be forced into any bank.	Expects card with this side number to be read — displays that side number. If another side is entered or if partition is incorrect, card is passed but not read — display flashes card side passed.
Any other number	Card is passed but not read — rightmost two integers in display flash.	Same as for normal program

If the display is flashing any value when trying to read a card, the card is passed but not read and the rightmost two integers in the display are flashed.

The calculator should not be in fix-decimal format when reading cards.

Be sure your calculator battery pack is well charged or connected to an AC outlet before attempting any lengthy calculations. This is especially critical to the accuracy of reading and writing magnetic cards.

A flashing 0 in the display after reading a card indicates that the card has not been read correctly and should be reread.

RECORDING MAGNETIC CARDS (TI-59 Only)

Display When 2nd Write Pressed, Card Entered	Normal Program	Protected Program
1, 2, 3, 4	Writes a card side with this number from the bank of this number (program and/or data) and records current partition on card.	If bank contains only program, card is passed but not written — display number flashes. If bank contains some data, bank is recorded but not protected with minus side number on the card.
-1, -2, -3, -4	Writes and protects card side with this number from the bank with this number. Also records current partition on card.	If bank contains only program, card is passed but not written — display number flashes. If bank contains some data, bank is recorded with minus side number.
Any other number	Card is passed, but not recorded. Rightmost two integer digits of display are flashed.	Same as for normal program.

If the display is flashing when trying to write a card, the card is passed but no recording takes place and the rightmost two integer digits are flashed.

The calculator should not be in fix-decimal format when recording cards.

For any flashing display the Drive motor continues to run until the card is removed.

MASTER LIBRARY USER INSTRUCTIONS

The remainder of this booklet contains the user instructions for each program of the Master Library.

REMOVING AND INSTALLING MODULES

The Master Library module is installed in the calculator at the factory, but can easily be removed or replaced with another. It is a good idea to leave the module in place in the calculator except when replacing it with another module. Be sure to follow these instructions when you need to remove or replace a module.

CAUTION

Be sure to touch some metal object before handling a module to prevent possible damage by static electricity.

1. Turn the calculator OFF. Loading or unloading a module can short the contacts, seriously damaging the module and/or the calculator if the calculator is ON during the loading or unloading.
2. Slide out the small panel covering the module compartment at the bottom of the back of the calculator. (See Diagram below).
3. Remove the module. You may turn the calculator over and let the module fall out into your hand.
4. Insert the module, notched end first with the labeled side up into the compartment. The module should slip into place effortlessly.
5. Replace the cover panel, securing the module against the contacts.

MASTER LIBRARY DIAGNOSTIC

ML-01

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	Diagnostic/Module Check			
A1	Select Program		2nd Pgm 01	
A2	Run Diagnostic or		SBR =	1. ¹
A3	Library Module Check		SBR 2nd R/S	1. ²
	Initialize Linear Regression			
B1	Select Program		2nd Pgm 01	
B2	Initialize Linear Regression		SBR CLR	0.
	Print Routine			
C1	Select Program		2nd Pgm 01	
C2	Set calculator to print input and output for user-defined keys of program numbered mm ³ . Now the User Instructions for that program can be followed except that the program need not be called.	mm	STO 00	mm

- NOTES:**
1. This output is obtained if the calculator is operating properly.
 2. The number 1 indicates the Master Library.
 3. The Master Library programs are numbered 1 through 25. Program number 0 is the calculator's program memory.

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 02	
2	Enter order of matrix	n	A	n*
3	Enter elements of matrix A by columns starting with column 1. (To correct an entry in column j, simply enter j and press B . Then reenter the entire column using the R/S key)	1 a ₁₁ a ₂₁ . . a _{n1} a ₁₂ a ₂₂ . . a _{nn}	B R/S R/S . R/S R/S R/S . R/S C	1. a ₁₁ * a ₂₁ * . . a _{n1} * a ₁₂ * a ₂₂ * . . a _{nn} *
4	Calculate determinant If $ A \neq 0$: Solve $Ax = b$ (Perform Steps 1-4 first)			A *
5	Enter elements of column vector b starting with b ₁ . (To correct an entry error for b _i , simply enter i and press D . Then reenter b _i using the R/S key.)	1 b ₁ . . b _n	D R/S . R/S	1. b ₁ * . b _n *
6	Calculate x		CLR E	1.
7	Display the elements of x, starting with x ₁	1	2nd A' R/S . R/S	1. x ₁ * . x _n *
8	To display x _i only To solve the system for a new vector b', repeat Steps 5-8 only.	i	2nd A' R/S	i x _i *

	If $A \neq 0$: Find A^{-1} (Perform Steps 1-4 first)			
9	Calculate A^{-1}		CLR 2nd B	1.
10	Display the elements of A^{-1} by columns starting with column 1: (To display the elements of A^{-1} starting with column j, enter j before pressing 2nd C). Due to pivoting, A^{-1} may be stored with its columns permuted even though it is displayed in the correct order. Therefore, A^{-1} must be reentered for use in subsequent calculations. Note: A is lost once A^{-1} is calculated.	1	2nd C R/S R/S . . R/S R/S . . R/S 2nd E	1. $a_{11}^{-1} *$ $a_{21}^{-1} *$. . $a_{n1}^{-1} *$ $a_{12}^{-1} *$. . $a_{nn}^{-1} *$
11	To compute $ A $ and A^{-1} simultaneously, perform Steps 1-3, then perform this step and continue with Step 10 to display A^{-1} if $ A \neq 0$.			$ A *$

*These values are automatically printed when the PC-100A Print Cradle is connected.

MATRIX ADDITION AND MULTIPLICATION

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 03	
2a	Enter number of rows in A	m	A	$m *$
2b	Enter number of columns in A (Steps 2a and 2b must be performed in sequence)	n	A	$n *$
3	Enter the elements of matrix A starting with column 1. (To correct an entry error in column j, simply enter j and press B). Then reenter the entire column using the R/S key)	1 a_{11} a_{21} . . a_{m1} a_{12} a_{22} . . a_{mn}	B R/S R/S . . R/S R/S R/S . . R/S	1. $a_{11} *$ $a_{21} *$. . $a_{m1} *$ $a_{12} *$ $a_{22} *$. . $a_{mn} *$

*These values are printed automatically if the PC-100A is connected.

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	For Matrix Addition:			
4	First Then enter the elements of matrix B using the [R/S] key as in Step 3. (To correct an entry error in column j, simply enter j and press [C] . Then reenter the entire column using the [R/S] key.	1	[C]	1
5a	Enter λ_1	λ_1	[D]	λ_1^*
5b	Enter λ_2 (Steps 5a and 5b must be performed in sequence. These steps are required even if $\lambda_1 = 1$ and/or $\lambda_2 = 1$)	λ_2	[D]	λ_2^*
6	Calculate $C = \lambda_1 A + \lambda_2 B$		[CLR] [E]	1.
7	Display the elements of C starting with column 1: To display the elements of C starting with column j, enter j before pressing [2nd] [A] . (To use C as the new A, repeat Steps 4-7. For a new case go to Step 2.)	1	[2nd] [A] [R/S] [R/S] : [R/S] [R/S] [R/S] : [R/S]	1. c_{11}^* c_{21}^* : c_{m1}^* c_{12}^* c_{22}^* : c_{mn}^*
	For Matrix Multiplication (Perform Steps 1-3 first)			
8	Enter the elements of column j of matrix B starting with b_{1j} . (To correct an entry error for b_{ij} , enter i, press [2nd] [B] and reenter b_{ij} using the [R/S] key.)	1 b_{1j} : b_{nj}	[2nd] [B] [R/S] : [R/S]	1. b_{1j}^* : b_{nj}^*
9	Calculate column j of matrix C		[2nd] [C]	1.
10	Display the elements of column j of matrix C, starting with c_{1j}	1	[2nd] [D] [R/S] : [R/S]	1. c_{1j}^* : c_{mj}^*
11	To display c_{ij} only	i	[2nd] [D] [R/S]	i c_{ij}^*
12	To compute $AB = C$, repeat Steps 8-10 for $j = 1$ to $j = p$			

NOTE: 1. This program includes its own print commands and should not be used with program ML-01.

*These values are printed automatically if the PC-100A is connected.

COMPLEX ARITHMETIC

ML-04

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 04	
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
3a	Enter real part of Y	c	2nd A'	c
3b	Enter imaginary part of Y (3a and 3b must be performed in sequence)	d	2nd A'	d
	Perform either Step 4, 5, 6, 7, 8, 9, or 10.			
4	Calculate $X + Y$		B x↔t	real part imaginary part
5	Calculate $X - Y$		2nd B' x↔t	real part imaginary part
6	Calculate $X \times Y$		C x↔t	real part imaginary part
7	Calculate $X \div Y$		2nd C' x↔t	real part imaginary part
8	Calculate Y^X		D x↔t	real part imaginary part
9	Calculate $\log_Y X$		2nd D' x↔t	real part imaginary part
10	Calculate $\sqrt[n]{Y}$		E x↔t	real part imaginary part
	After a calculation, the result becomes the new X.			
11	To swap X and Y		2nd E'	0.

COMPLEX FUNCTIONS

ML-05

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 05	
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
3	Calculate polar form of X, if desired		B x↔t	r θ
	Perform either Step 4, 5, 6, 7, or 8			
4	Calculate X^2		C x↔t	real part imaginary part
5	Calculate $\sqrt{X}$		D x↔t	real part imaginary part
6	Calculate $1/X$		E x↔t	real part imaginary part
7	Calculate $\ln X$		2nd A' x↔t	real part imaginary part
8	Calculate e^X		2nd B' x↔t	real part imaginary part
	After a calculation, the result becomes the new X.			

COMPLEX TRIGONOMETRIC FUNCTIONS

ML-06

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 06	
2a	Enter real part of X	a	A	a
2b	Enter imaginary part of X (2a and 2b must be performed in sequence)	b	A	b
	Perform either Step 3, 4, 5, 6, 7, or 8			
3	Calculate sin X		B x<=t	real part imaginary part
4	Calculate cos X		C x<=t	real part imaginary part
5	Calculate tan X		D x<=t	real part imaginary part
6	Calculate $\sin^{-1} X$		2nd B' x<=t	real part imaginary part
7	Calculate $\cos^{-1} X$		2nd C' x<=t	real part imaginary part
8	Calculate $\tan^{-1} X$		2nd D' x<=t	real part imaginary part

- NOTES:**
1. After a calculation, the result becomes the new X.
 2. X is expressed in radians. Program leaves calculator in radian mode.

POLYNOMIAL EVALUATION

ML-07

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 07	
2	Enter n^1	n	A	n^*
3	Enter all coefficients ² starting with a_0 (To correct a_i , enter i , press B and reenter a_i with the R/S key.)	0 a_0 a_1 : : a_n	B R/S R/S : R/S	0. a_0^* a_1^* : a_n^*
4	Enter x and compute $P(x)$	x	C	$P(x)^*$
5	For a new value of x repeat Step 4			

- NOTES:
1. Number of data registers available $\geq n + 6$.
 2. Even if a coefficient is zero, it must be entered.
 3. This program contains print commands and should not be used with program ML-01.

*These values are printed automatically if the calculator is connected to the PC-100A Print Cradle.

ZEROS OF FUNCTIONS

ML-08

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Initialize		RST	0.
2	Select learn mode		LRN	000 00
3	Use A' as label		2nd LBL 2nd A'	001 00 002 00
4	Enter f(x) as a series of keystrokes. Do not use = or CLR . Do not use registers 0-8.			
5	End f(x) with INV SBR		INV SBR	xxx 00
6	Leave learn mode		LRN	0.
7	Select program		2nd Pgm 08	
8	Enter lower limit	a	A	a
9	Enter upper limit	b	B	b
10	Enter sampling increment ¹	Δx	C	Δx
11	Enter maximum error ²	ϵ	D	ϵ
12	Calculate roots. Repeat this step until flashing 9's display is obtained which indicates all roots in [a,b) have been found.		E	root
13	To use a different interval, Δx , or ϵ , repeat Steps 8-12.			

- NOTES:
1. If Δx is not entered, $b - a$ is assumed.
 2. If ϵ is not entered, .01 is assumed.
 3. Evaluate expressions using parentheses only.
 4. [a,b) is a notation which means that a is included in the interval but b is not.
 5. Program may run for several minutes, depending on input data.

SIMPSON'S APPROXIMATION (CONTINUOUS)

ML-09

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Initialize		RST	0.
2	Select learn mode		LRN	000 00
3	Use A' as label		2nd Lbl 2nd A'	001 00 002 00
4	Enter f(x) as a series of keystrokes. Do not use = or CLR . Do not use registers 0-5.			
5	End f(x) with INV SBR		INV SBR	xxx 00
6	Leave learn mode		LRN	0.
7	Select program		2nd Pgm 09	
8	Enter lower limit	x_0	A	x_0
9	Enter upper limit	x_n	B	x_n
10	Enter n (n = 2, 4, 6, . . . , display flashes if not legal entry)	n	C	h
11	Compute integral		D	I
12	For a new interval or a new n, repeat Steps 7-11.			

- NOTE:
1. Evaluate expressions using parentheses only.
 2. Running time is dependent on input data.

SIMPSON'S APPROXIMATION (DISCRETE)

ML-10

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 10	
2	Enter n ($n = 2, 4, 6, \dots$, display flashes if not a legal entry). See note 2.	n	A	n^*
3	Enter h	h	B *	h^*
4	Enter function values starting with f_0	0 f_0 f_1 $\vdots$ f_n	C R/S R/S $\vdots$ R/S	0. f_0^* f_1^* $\vdots$ f_n^*
5	Calculate integral		D	I^*

- NOTES:
1. This program contains print commands, and should not be used with program ML-01.
 2. $n + 7 \leq \text{No. of data registers}$.

*These values are printed automatically if the calculator is connected to the PC-100A Print Cradle.

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 11	
2	Initialize		2nd E'	0.
3	Select degree, grad, or radian mode			
	Knowing SSS			
4	Enter a	a	A	a
5	Enter b	b	B	b
6	Enter c	c	C	c
7	Calculate $\angle A$		2nd A	$\angle A'$
8	Calculate $\angle B$		2nd B'	$\angle B'$
9	Calculate $\angle C$		2nd C'	$\angle C'$
	Knowing SSA			
10	Enter a	a	A	a
11	Enter b	b	B	b
12	Enter $\angle A$	$\angle A$	C	$\angle A$
13	Calculate c		D	c'
14	Calculate $\angle B$		2nd B'	$\angle B'$
15	Calculate $\angle C$		2nd C'	$\angle C'$
	Knowing SAS			
16	Enter a	a	A	a
17	Enter b	b	B	b
18	Enter $\angle C$	$\angle C$	C	$\angle C$
19	Calculate c		E	c'
20	Calculate $\angle B$		2nd B'	$\angle B'$
21	Calculate $\angle A$		2nd C'	$\angle A'$

- NOTES:**
1. Input data must be reentered following each set of calculations.
 2. A flashing display indicates there is no triangle satisfying the input data.
 3. All inputs should be entered in the sequence shown, all outputs should be calculated in the order shown. Do not omit any steps except output steps which follow the last part in question.

TRIANGLE SOLUTIONS (2)

ML-12

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 12	
2	Select degree, grad, or radian mode			
	Knowing ASA			
3	Enter a	a	A	a
4	Enter $\angle B$	$\angle B$	B	$\angle B$
5	Enter $\angle C$	$\angle C$	C	$\angle C$
6	Calculate $\angle A$		2nd A	$\angle A$
7	Calculate b		D	b
8	Calculate c		E	c
	Knowing SAA			
9	Enter a	a	A	a
10	Enter $\angle A$	$\angle A$	B	$\angle A$
11	Enter $\angle C$	$\angle C$	C	$\angle C$
12	Calculate $\angle B$		2nd B	$\angle B$
13	Calculate b		D	b
14	Calculate c		E	c
	Calculate Area			
15	Calculate area of triangle. Sides b, c, a must have been previously computed and consequently reside in R_{01} , R_{02} , and R_{07} , respectively. If not, they can be manually placed there.		2nd C	Area

- NOTES:**
1. Input data must be reentered after each set of calculations.
 2. For a triangle solution in program ML-11, the area may be calculated by pressing **2nd** **Pgm** 12, **RCL** 06, **STO** 07, **2nd** **C** without reentering the data.
 3. All inputs should be entered in the sequence shown, all outputs should be calculated in the order shown. Do not omit any steps except those which follow the last part in question.

CURVE SOLUTION

ML-13

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 13	
2	Enter one pair from the following			
	a. Enter θ	θ	A	θ
	a. Enter r	r	B	r
	or			
	b. Enter θ	θ	A	θ
	b. Enter s	s	C	s
	or			
	c. Enter θ	θ	A	θ
	c. Enter c	c	D	c
	or			
	d. Enter r	r	B	r
	d. Enter s	s	C	s
	or			
	e. Enter r	r	B	r
	e. Enter c	c	D	c
3	See Note 1			
4	Calculate θ'		2nd A'	θ'
5	Calculate r		2nd B'	r'
6	Calculate s		2nd C'	s'
7	Calculate c		2nd D'	c'
8	Calculate A		E	A'
9	Calculate a		2nd E'	a'

- NOTES:**
1. All steps 4 through 9 must be performed in sequence. Values entered in Step 2 may be omitted.
 2. θ is expressed in radians. Program leaves calculator in radian mode.

NORMAL DISTRIBUTION

ML-14

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 14	
2	Enter data and calculate Z(x)	x^1	A	Z(x)
3	Calculate Q(x)		B	Q(x)

- NOTES:
1. $|x| \leq 15.11$, display will flash for x outside this range.
 2. Z(x) must be calculated before Q(x).
 3. $Z(-x) = -Z(x)$ and $Q(-x) = 1 - Q(x)$.
 4. $P(x) = 1 - Q(x)$.

RANDOM NUMBER GENERATOR

ML-15

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 15	
2	Initialize		2nd ⌈	0.
3	Enter random number seed ($0 \leq \text{seed} \leq 199017$)	seed	E	seed
	For Uniform Distribution			
4	Enter lower limit	A	A	A
5	Enter upper limit	B	B	B
6	Generate random number (Repeat as needed)		C	Random No.
	For Normal Distribution			
7	Enter desired mean	$\bar{x}$	A	Desired $\bar{x}$
8	Enter desired standard deviation	σ	B	Desired σ
9	Generate random number (Repeat as needed)		2nd C	Random No.
	For Either Distribution			
10	Compute actual mean of generated numbers		2nd $\bar{x}$	Actual $\bar{x}$
11	Compute actual standard deviation of generated numbers		INV 2nd $\bar{x}$	Actual σ
12	Display number of generated numbers		RCL 03	N
	For Range of (0,1)			
13	Generate random number (Repeat as needed)		SBR 2nd D.MS	Random No.

NOTE: 1. Five significant digits of the originally generated number are retained for further calculations. Therefore, no more than the first five significant digits of the generated numbers may be considered to be random.

COMBINATIONS, PERMUTATIONS, FACTORIALS

ML-16

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 16	
2a	Enter n	n	A	Integer n
2b	Enter r ($0 \leq r \leq n$) (2a must precede 2b)	r	B	Integer r
	Factorial			
3	Calculate factorial of n ($0 \leq n \leq 69$)		C	n!
	Permutations			
4	Calculate number of possible permutations		D	P_r^n
	Combinations			
5	Calculate number of possible combinations		E	C_r^n

- NOTES:
- For $r > n$ the display flashes 9.9999999 99.
 - The display flashes 9.9999999 99 for overflow in the calculation.
 - For negative entries of either n or r, the absolute values are used and the display flashes the result.
 - For non-integer values of either n or r, only the integer values are used and the display flashes the results.
 - Step 2 must be repeated for each calculation.
 - Running time is dependent upon input data.

MOVING AVERAGES

ML-17

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 17	
2	Initialize		2nd E'	0.
3	Enter number of values to be averaged	n ¹	A	n
4	Enter value to be averaged Repeat for each value.	m	B	average ²

- NOTES:
1. Error conditions:
For $n \leq 0$ or n non-integer, the display will flash 9.9999999 99.
 2. An average will be taken for all values entered below the n th value. Once the n th value is entered, the concept of moving averages begins.
 3. The number of data registers available must be greater than or equal to $n + 5$.

COMPOUND INTEREST (EUROPEAN METHOD)

ML-18

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	U.S. Method			
1	Select program		2nd Pgm 18	
2	Initialize		2nd ⌈	0.00
3	Enter three of the following four variables in any order:			
	Number of periods	N	A	N
	Interest rate (percent per period)	%I	B	%I
	Present value	PV	C	PV
	Future value	FV	D	FV
4	Calculate the remaining variable			
	Number of periods	0	A	N
	Interest rate (percent per period)	0	B	%I
	Present value	0	C	PV
	Future value	0	D	FV
	Annuity Formulas			
	(See Note 1 below and Notes on Annuity Formulas)			
5	Solve for $S_{\overline{n} i}$		2nd A'	$S_{\overline{n} i}$
6	Solve for $(1+i) S_{\overline{n} i}$		2nd B'	$(1+i) S_{\overline{n} i}$
7	Solve for $a_{\overline{n} i}$		2nd C'	$a_{\overline{n} i}$
8	Solve for $(1+i) a_{\overline{n} i}$		2nd D'	$(1+i) a_{\overline{n} i}$

NOTE: 1. Steps 5-8 assume the following:
N is stored in R_{01} .
 $I \div 100$ is stored in R_{08} .
 $(I \div 100) + 1$ is stored in R_{09} .

COMPOUND INTEREST (US METHOD)

ML-18

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
	European Method			
1	Select program		2nd Pgm 18	
2	Initialize		2nd ⌈	0.00
	If annual interest rate is known			
3	Solve for I_{eff} per period			
3A	Enter periods per year	N_c	A	N_c
3B	Enter 1 as PV	1	C	1.00
3C	Enter $(1 + I_{\text{ann}}/100)$ as FV	$1 + I/100$	D	FV
3D	Solve for I_{eff} per period	0	B	I_{eff}
4	Enter two of the following three variables in any order:			
	Number of periods	N	A	N
	Present value	PV	C	PV
	Future value	FV	D	FV
5	Calculate the remaining variable:			
	Number of periods	0	A	N
	Present value	0	C	PV
	Future value	0	D	FV
	To solve for I_{ann}, given PV, FV, N			
6	Number of periods	N	A	N
7	Present value	PV	C	PV
8	Future value	FV	D	FV
9	Solve for I per period	0	B	$I(\text{period})$
10	Solve for annual interest rate (I_{ann})			
10A	Periods per year (N_c)	N_c	A	N_c
10B	Enter 1 for PV	1	C	1.00
10C	$FV = 1 + I_{\text{ann}}/100$	0	D	$1 + I_{\text{ann}}/100$
10D	Subtract 1 and multiply by 100		-	
		1	= X	
		100	=	I_{ann}

ANNUITIES

ML-19

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 19	
2	Initialize		2nd E'	0.
3	Select type of routine: Sinking Fund Annuity Due/FV Ordinary Annuity/PV Annuity Due/PV		2nd A' 2nd B' 2nd C' 2nd D'	0. 0. 0. 0.
4	Enter the known variables in any order Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment ¹	N %I PMT PV or FV BAL	A B C D E	N %I PMT PV or FV BAL
5	Solve for the unknown variable Number of Periods Interest Rate (percent per period) Payment per Period PV or FV Balloon Payment	0 0 0 0 0	A B C D E	N %I PMT PV or FV BAL
6	To solve another problem of the same type, go to Step 4 (See Note 2). For a problem of a different type, go to Step 2.			

- NOTES:**
1. If balloon payment does not apply, **DO NOT** enter zero. Merely skip the step.
 2. If balloon payment was non-zero in the previous problem and is zero in the new problem, go to Step 2.

DAY OF THE WEEK, DAYS BETWEEN DATES

ML-20

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program Days Between Dates		2nd Pgm 20	
2	Enter first date	MMDD.YYYY	A	0.
3	Enter second date	MMDD.YYYY	B	0.
4	Calculate number of days between given dates Day of the Week		C	No. of days
5	Enter date and calculate day of week * 0 – Sat 4 – Wed 1 – Sun 5 – Thurs 2 – Mon 6 – Fri 3 – Tues	MMDD.YYYY	D	Day of week *

- NOTES:
1. Date must be entered in the order: month day year
 2. Error conditions
 - a. negative inputs
 - b. $DD > 31$
 - c. $MM > 12$
 - d. $YYYY < 1582$

HI-LO GAME

ML-21

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program You Guess		2nd Pgm 21	
2	Key in a number (0 to 1)*	Number	A	0.
3	Generate secret number		B	0.
4	Enter your guess (1 to 1023) Clue: -1. if guess was low 1. if guess was high flashing 0. if your guess was correct	Guess	C	Clue
5	Repeat Step 4 as required			
6	Display score		D	Score
7	For a new number, go to Step 3 Calculator Guesses			
8	Select a number (1 to 1023)			
9	Display calculator's first guess		2nd A'	Calc. guess
10	If calculator's guess is: Low High Correct		2nd B' 2nd C' 2nd D'	Calc. guess Calc. guess Calc. guess
11	Repeat Step 10 as required			
12	For a new game, go to Step 8			

*Each number you select will produce a different game.

CHECKING/SAVINGS ACCOUNT MANAGEMENT

ML-22

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 22	
2	Load data registers from card ¹ or Enter checking balance Enter savings balance	C. Bal S. Bal	2nd A E 2nd B E	C. Bal. S. Bal.
3	Select checking mode		2nd A	
4	Enter deposit amount	Dep. amt.	B	New Bal.
5	Enter check amount	Chk. amt.	C	New Bal.
6	Repeat 4 and 5 as necessary			
7	Select savings mode		2nd B	
8	To add interest: Enter annual interest rate (%) Enter compounding periods per year Enter number of periods	%l/yr P N	2nd C 2nd D D	%l/yr %/per. New Bal.
9	To add savings deposit	Dep. amt.	B	New Bal.
10	To subtract savings withdrawal	Withdr. amt.	C	New Bal.
11	To display checking balance		2nd A A	Chk. Bal.
12	To display savings balance		2nd B A	Sav. Bal.
13	Optional: Record data registers on card ¹			

NOTE: 1. For TI Programmable 59 only.

DMS OPERATIONS

ML-23

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 23	
2	Enter number n (dd.mmss)	n	A	n(dec. deg.)
	For Addition or Subtraction			
3	For addition, enter number p(dd.mmss)	p	B	(n + p)
4	For subtraction, enter number p(dd.mmss)	p	+/- B	(n - p)
	For Multiplication or Division			
5	For multiplication, enter scalar a	a	C	(n X a)
6	For division, enter scalar a	a	D	(n ÷ a)

- NOTES:**
1. Display is in Fix 4 format after any of the four operations is performed.
 2. For chained operations, the result of an operation should be used directly as the entered number in Step 2. This will minimize rounding errors.

UNIT CONVERSIONS (1)

ML-24

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 24	
2	To convert:			
	inches to centimeters	inches	A	cm
	centimeters to inches	cm	2nd A'	inches
	feet to meters	feet	B	meters
	meters to feet	meters	2nd B'	feet
	yards to meters	yards	C	meters
	meters to yards	meters	2nd C'	yards
	miles to kilometers	miles	D	km
	kilometers to miles	km	2nd D'	miles
	miles to nautical miles	miles	E	nau. miles
	nautical miles to miles	nau. miles	2nd E'	miles

UNIT CONVERSIONS (2)

ML-25

STEP	PROCEDURE	ENTER	PRESS	DISPLAY
1	Select program		2nd Pgm 25	
2	To convert:			
	°F to °C	°F	A	°C
	°C to °F	°C	2nd A'	°F
	fluid ounces to liters	fl. oz.	B	liters
	liters to fluid ounces	liters	2nd B'	fl. oz.
	U.S. gallons to liters	gallons	C	liters
	liters to U.S. gallons	liters	2nd C'	gallons
	ounces to grams	ounces	D	grams
	grams to ounces	grams	2nd D'	ounces
	pounds to kilograms	pounds	E	kg
	kilograms to pounds	kg	2nd E'	pounds

PROGRAM REFERENCE DATA

APPENDIX A

Program Number	Title	No. of Steps	Data Reg. Used	Flags Used	SBR. Levels	Paren. Levels	Calls Pgm.	Special Functions Used	$x \geq t$	ABS. Address.	Fix Decimal	EE*	=	Angular Mode	Program Number
01	Diagnostic	189	0-6, 9		1	4	15	N/A	CP		9			Deg	01
02	Determinant, Matrix, Simultaneous Equations	898	1-15 min.		2	1			X	X			Used		02
03	Matrix Addition and Multiplication	274	1-7 min.		1	1			X				Used		03
04	Complex Arithmetic	167	1-4		3	2	5	P/R	X					Rad	04
05	Complex Functions	119	1-4		2	2	4	P/R	X					Rad	05
06	Complex Trig Functions	250	1-4		2	4	4,5	P/R	X			X		Rad	06
07	Polynomial Evaluation	78	1-4		0	1			X						07
08	Zeros of Functions	144	1-8		1	1	00		X						08
09	Simpson's Approximation (Continuous)	118	1-5		1	1	00		X						09
10	Simpson's Approximation (Discrete)	123	1-9 min.		0	1			X						10
11	Triangle Solution (1)	195	1-6	0-3	0	2						X			11
12	Triangle Solution (2)	155	1-7	0	0	2									12
13	Curve Solution	188	1-4	0,1	1	3			CP					Rad	13
14	Normal Distribution	143	1-3	1	0	2			CP						14
15	Random Number Generator	136	1-11		1	3	1	$\Sigma+$	CP					Rad	15
16	Combinations, Permutations, Factorials	132	1-4	1	1	0			X						16
17	Moving Averages	117	1-7 min.	1	0	1			X						17
18	Compound Interest	171	1-4, 8, 9, 12		2	3			CP		2				18
19	Annuities	589	1-14	1-4	3	3	18		X	X	2,4,9				19
20	Day of the Week, Days Between Dates	191	1-5		1	5			X						20
21	Hi-Lo	95	1-5, 9		1	4	15		X						21
22	Checking/Savings Acct.	94	1-10		1	1	18		CP		2				22
23	DMS Operations	52	1		1	5		DMS			4				23
24	Unit Conversions (1)	96	—		1	1									24
25	Unit Conversions (2)	124	—		1	2									25
	Pointers & Counters	162													

*Does not run in ENG format

TEXAS INSTRUMENTS

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GB. RG. 355 247S